

POWER SUPPLY SUPERVISORY CIRCUITS

IP1543, IP3543

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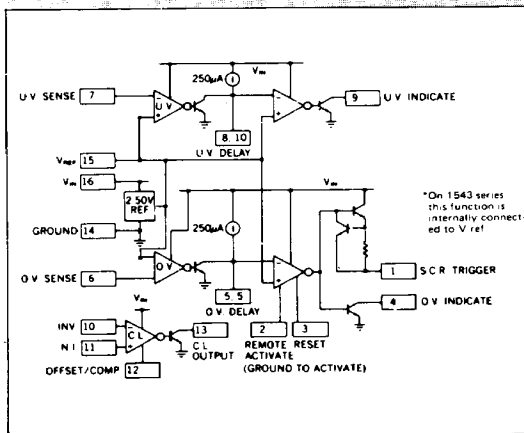
DESCRIPTION

The IP1543 and IP3543 power supply supervisory circuits contain all the functions necessary to monitor and control the output of a sophisticated power supply system. Included on the chip are over-voltage (O.V.) sensing with externally programmable delay used to trigger an external SCR "Crowbar", under-voltage (U.V.) sensing with externally programmable delay used to sense either the power supply output or the line input voltage, a third op-amp/comparator with provision for external compensation and/or offset programming used for either current limiting or as an additional voltage monitor, and a voltage reference trimmed to $\pm 1\%$.

FEATURES

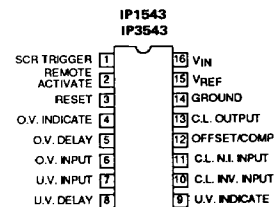
- 4.5 to 40V operation over full temperature range
- Reference voltage trimmed to 1% accuracy
- Includes over-voltage, under-voltage and current sensing
- Programmable time delays
- SCR "Crowbar" drive of 300mA
- Remote activation capability
- Optional over-voltage latch capability

BLOCK DIAGRAM



CONNECTIONS

(Top View)



N, J and D (300) Package



POWER SUPPLY SUPERVISORY CIRCUITS**ABSOLUTE MAXIMUM RATINGS**

Sense Inputs	V_{IN}	$T_C = +25^{\circ}\text{C}$ (Note 3)	2000mW
SCR Trigger Current (Note 1)	Internally Limited	Operating Junction Temperature	+150°C
Indicator Output Voltage +40V		Storage Temperature Range	-65°C to +150°C
Indicator Output Sink Current	50mA	Lead Temperature (Soldering, 10 seconds)	+300°C

Absolute maximum ratings are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the device should be operated at these limits. The electrical characteristics provide conditions for actual device operation.

Note 1. At higher input voltages, a dissipation limiting resistor, R_G , is required.

Note 2. Derate at 10mW/°C for ambient temperatures above +50°C.

Note 3. Derate at 16mW/°C for case temperatures above +25°C.

RECOMMENDED OPERATING CONDITIONS (Note 4)

Input Supply Voltage (V_{IN})	+4.5V to +40V	Indicate Output Current	0 to 10mA
Current Limit Common Mode Range		Operating Ambient Temperature Range	
Input Voltage Range	0 to $V_{IN} - 3\text{V}$	IP1543	-55°C to +125°C
Reference Load Current	0 to 10mA	IP3543	0°C to +70°C

Note 4. Range over which the device is functional and parameter limits guaranteed.

ELECTRICAL CHARACTERISTICS

+ $V_{IN} = +10\text{V}$

Parameter	Test Conditions	IP1543			IP3543			Units
		Min	Typ	Max	Min	Typ	Max	
Input Voltage Range		4.5		40	4.5		40	V
Supply Current	$V_{IN} = 40\text{V}$		7	10		7	10	mA
Reference Section								
Output Voltage		2.48	2.50	2.52	2.45	2.50	2.55	V
		2.45		2.55	2.40		2.60	V
Line Regulation	$V_{IN} = 4.5$ to 30V		1	5		1	5	mV
Load Regulation	$I_{REF} = 0$ to 10 mA		1	10		1	10	mV
Short Circuit Current	$V_{REF} = 0$	12	25	40	12	25	40	mA
Temperature Stability	Over Operating Range		50			50		ppm/°C
SCR Trigger Section								
Peak Output Current	$V_{IN} = 5\text{V}$, $R_G = 0$, $V_O = 0$	100	200	400	100	200	400	mA
Peak Output Voltage	$V_{IN} = 15\text{V}$, $I_O = 100$ mA	12	13		12	13		V
Output Off Voltage	$V_{IN} = 40\text{V}$		0	0.1		0	0.1	V
Remote Activate Current	Pin 2 = Gnd		-1	-8		-1	-8	mA
Remote Activate Voltage	Pin 2 = Open		1.5	6		1.5	6	V



POWER SUPPLY SUPERVISORY CIRCUITS

ELECTRICAL CHARACTERISTICS (CONTINUED)

Parameter	Test Conditions		IP1543			IP3543			Units
			Min	Typ	Max	Min	Typ	Max	
Reset Current	Pin 3 = Gnd, Pin 2 = Gnd	•		-.1	-.8		-.1	-.8	mA
Reset Voltage	Pin 3 = Open, Pin 2 = Gnd	•		1.5	6		1.5	6	V
Output Current Rise Time	$R_L = 50\Omega$			400			400		mA/ μ S
Prop. Delay from Pin 2	$C_D = 0$ $V_{(Pin\ 2)} = 0.4V$			300			300		ns
Prop. Delay from Pin 6	$V_{(Pin\ 6)} = 2.7V$			500			500		ns

Comparator Sections

Input threshold (Input Voltage Rising on Pin 6, falling on Pin 7)			2.45	2.50	2.55	2.40	2.50	2.60	V
			• 2.40		2.60	2.35		2.65	V
Input Hysteresis				25			25		mV
Input Bias Current	Sense Input = 0V	•		-0.3	-1.0		-0.3	-1.0	μ A
Delay Saturation		•		0.2	0.5		0.2	0.5	V
Delay High Level		•		6	8		6	8	V
Delay Charging Current	$V_D = 0V$	•	200	250	300	200	250	300	μ A
Indicate Saturation	$I_L = -10\text{ mA}$	•		0.2	0.5		0.2	0.5	V
Indicate Leakage	$V_{IND} = 40V$	•		.01	1.0		.01	1.0	μ A
Propagation Delay	$V_{(Pin\ 6)} = 2.7V$ $C_D = 0$			400			400		ns
	$V_{(Pin\ 7)} = 2.3V$ $C_D = 1\mu F$			10			10		ms

Current Limit Section

Input Voltage Range		•	0		V_{IN-3}	0		V_{IN-3}	V
Input Bias Current	Pin 12 = Open, $V_{CM} = 0V$	•		-0.3	-1.0		-0.3	-1.0	μ A
Input Offset Voltage	Pin 12 = Open, $V_{CM} = 0V$	•		0	10		0	15	mV
	10k Ω from Pin 12 to Gnd	•	70	100	130	70	100	130	mV
CMRR	$0 \leq V_{CM} \leq 12V$, $V_{IN} = 15V$	•	60	70		60	70		dB
AVOL	Pin 12 = Open, $V_{CM} = 0V$	•	72	80		72	80		dB
Output Saturation	$I_L = -10\text{ mA}$	•		0.2	0.5		0.2	0.5	V
Output Leakage	$V_{IND} = 40V$	•		.01	1.0		.01	1.0	μ A
Small Signal Bandwidth	$A_V = 0\text{ dB}$			5			5		MHz
Propagation Delay	$V_{overdrive} = 100\text{ mV}$			200			200		ns

The • denotes the specifications which apply over the full operating temperature range, all others apply at $T_j = 25^\circ\text{C}$ unless otherwise specified.

ORDER INFORMATION

Part Number

IP1543J
IP3543D
IP3543J
IP3543N

Temperature Range

-55 $^\circ\text{C}$ to +125 $^\circ\text{C}$
0 $^\circ\text{C}$ to +70 $^\circ\text{C}$
0 $^\circ\text{C}$ to +70 $^\circ\text{C}$
0 $^\circ\text{C}$ to +70 $^\circ\text{C}$

Package

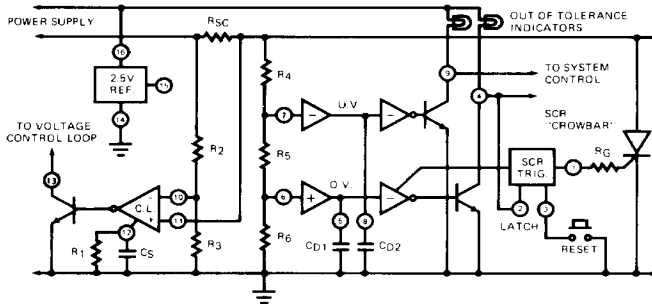
16 Pin Ceramic DIP
16 Pin Plastic (300) SOIC
16 Pin Ceramic DIP
16 Pin Plastic DIP



POWER SUPPLY SUPERVISORY CIRCUITS

APPLICATIONS INFORMATION

Typical Application



The values for the external components are determined as follows:

$$\text{Current limit input threshold, } V_{th} \approx \frac{1000}{R1}$$

C_s is determined by the current loop dynamics

$$\text{Peak current to load, } I_p \approx \frac{V_{th}}{R_{sc}} + \frac{V_o}{R_{sc}} \left(\frac{R2}{R2 + R3} \right)$$

$$\text{Short circuit current, } I_{sc} = \frac{V_{th}}{R_{sc}}$$

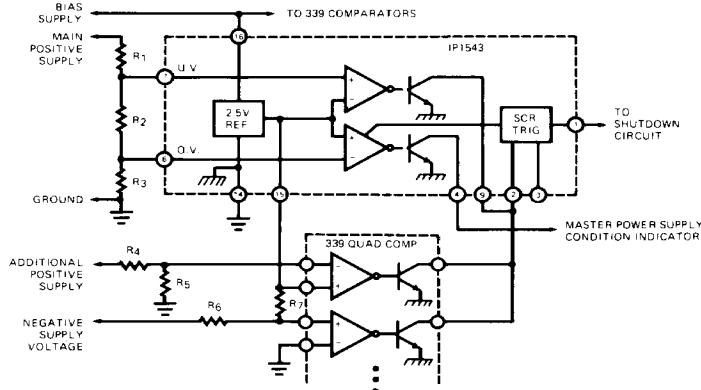
$$\text{Low output voltage limit, } V_o (\text{Low}) = \frac{2.5 (R4 + R5 + R6)}{R5 + R6}$$

$$\text{High output voltage limit, } V_o (\text{High}) = \frac{2.5 (R4 + R5 + R6)}{R6}$$

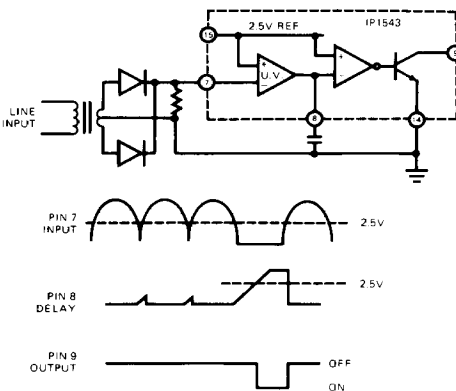
$$\text{Voltage sensing delay, } t_d = 10,000 C_d$$

$$\text{SCR trigger power limiting resistor, } R_g > \frac{V_{in} - 5}{0.2}$$

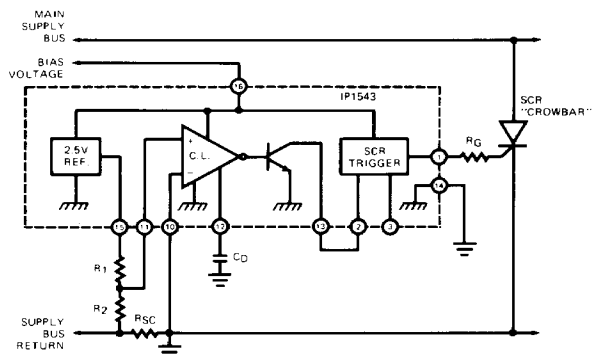
Sensing Multiple Supply Voltages



Input Line Monitor



Overcurrent Shutdown



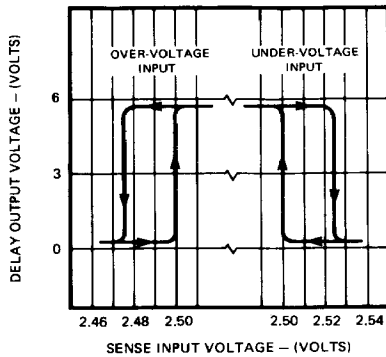
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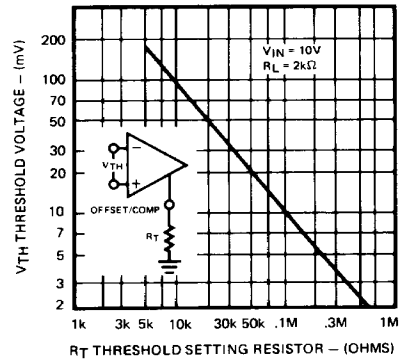
TYPICAL PERFORMANCE CHARACTERISTICS

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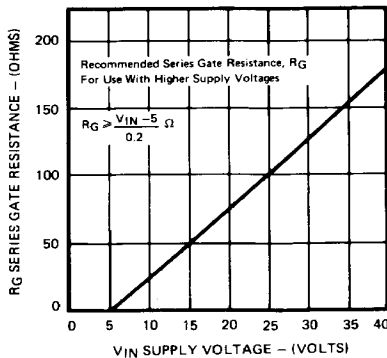
Comparator Input Hysteresis



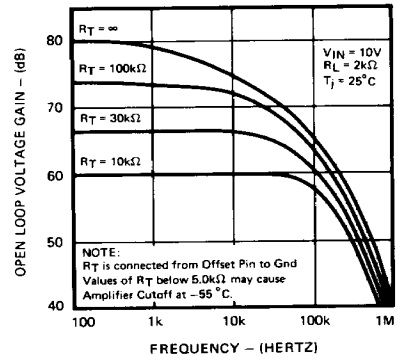
Current Limit Input Threshold



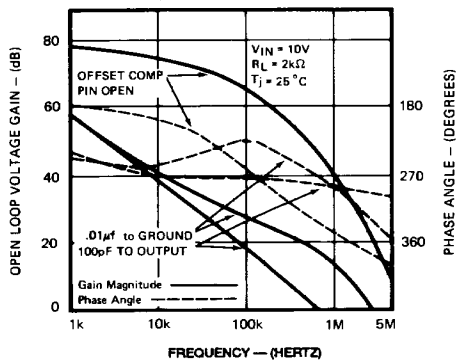
SCR Trigger Power Limiting



Current Limit Amplifier Gain



Current Limit Amplifier Frequency Response



Activation Delay vs. Capacitor Value

